REMARKS

Claims 1, 3 and 5-23 are pending in the application. Claims 2 and 4 are cancelled. Claims 18-23 have been withdrawn as being directed to a non-elected invention.

Claim 1 is amended to incorporate the subject matter of now cancelled claims 2 and 4 and claim 8. Claim 1 is also amended to recite the lances project into the upper portion of the vessel. Support for this amendment can be found at page 4, lines 21-22 of the published original PCT application WO 2004/007777 A2 upon which this application is based.

Claim 8 is amended to recite the lances are adjustable in height. Support for this amendment can be found at page 3, lines 30-32 of the above mentioned original published PCT application.

No new matter is presented by the above amendments.

I. Objection to the Drawings

The drawings have been objected to as failing to comply with 37 CFR 1.84(p)(4) because reference character "41" has been used to designate both a tap hole for tapping off molten iron and slag and a apparatus that aids in supplying iron oxide in the melting cyclone in Fig.7. It is also noted the reference "41" that points to the apparatus that aids in supplying iron oxide in the melting cyclone is not defined in the specification.

Applicants have submitted a "Replacement Sheet" of sheet 5/5 with a corrected Fig. 7 in compliance with 37 CFR 1.121(d). Applicants therefore request the objection to the drawings be withdrawn.

II. Claim Rejection under 35 U.S.C. §102(b).

Claims 1-11 and 16-17 are rejected under 35 U.S.C. §102(b) as being anticipated by Klaassen et al. (US 5,662,860).

In regards to claim 1, the Office action asserts the abstract, Fig. 2, and col. 3 lines 35-62 of Klaassen et al. disclose a metallurgical vessel for iron making comprising a bottom portion, a sidewall and a lance arrangement of at least two lances for supplying oxygen gas to the interior of the vessel in operation. Also, the Office action asserts each lance comprises an end portion for emitting oxygen gas wherein the lance arrangement is configured so as to achieve in operation a substantially downwardly directed flow of post-combusted gases at the side wall of the vessel. The Office action asserts the lance arrangement would also achieve a substantially upwardly directed flow of post-combusted gases in the center of the vessel

because the lances in Fig. 2 of Klaassen et al. are alleged to be oriented in the same way as Fig. 1 of the present application. The statement of vessel intended use has not been given any weight as a claim limitation.

In regards to claim 2, the Office action asserts Fig. 2 and col. 2, lines 36-46 teach at least one of the lances is provided with means for emitting a plurality of jets of oxygen containing gas from its end portion. Fig. 2 is alleged to show a plurality of jets emitted from the end of lance 23.

Regarding claim 3, the Office action asserts Klaassen et al. in Fig. 2 and Col. 3, lines 54-57 discloses the vessel has at least one lance projecting through the roof portion of the vessel.

In regard to claims 4-7, the Office action asserts Klaassen et al. in Fig. 2, col. 2, lines 41-46 and col. 3, lines 54-59 shows a metallurgical vessel wherein at least one lance is arranged to direct oxygen containing gas towards a central axis of the metallurgical vessel. Also, the Office action asserts Klaassen et al. discloses a vessel wherein at least one of the lances is inclined from the vertical under a first acute angle with its end portion inclined towards the central axis of the vessel (Fig. 2). Klaassen et al. is also said to teach part 20 in Fig. 2 can be enlarged cross-section to make it possible to position the lances more vertically. It is therefore asserted by changing the cross-section of part 20, "it would be possible for the metallurgical vessel wherein the end portion of the lance is configured to direct the oxygen containing gas towards the central axis of the vessel under a second acute angle from the vertical which second acute angle is greater than the first acute angle. The Office action also asserts Klaassen et al. at Fig. 2 shows the end portions of the lances are all of equal distance from the sidewall.

Regarding claim 8, the Office action asserts Klaassen et al. at col. 2, lines 36-46 teaches means for supplying oxygen to the vessel consisting of a plurality of lances projecting laterally through the wall of the vessel and the 'plurality" of lances is deemed to comprise three or more.

In regard to claims 9-11, Fig. 2, col. 2, lines 47-60 and col. 3, lines 52-54 of Klaassen et al. is said to disclose a metallurgical vessel wherein through at least one feed chute, particulate material is added to the vessel in the substantially downwardly directed flow of post-combusted gases. The vessel is said to have a plurality of feed chutes projecting through a roof portion of the vessel and each lance "could" have a corresponding feed chute since there can be multiple feed chutes.

Regarding claim 16, Fig. 2 and col. 2, lines 10-16 of Klaassen et al. are said to disclose a vessel comprising a melting cyclone mounted directly above and in direct open communication with the vessel.

In regard to claim 17, Fig. 2 and col. 2, lines 36-46 of Klaassen et al. are said to disclose a vessel wherein three lances are positioned to avoid contact with molten material passing downwards from the melting cyclone to the metallurgical vessel.

The Office action therefore concludes all critical elements required by claims 1-11 and 16-17 are "well taught and thus the claims are properly included in this rejection."

This rejection is respectfully traversed.

A. Klaassen et al. teaches away from the present invention

Applicants submit the essential feature of the present claimed invention is to generate a flow of post-combusted gases in the vessel by means of the claimed lance configuration with a downwardly directed flow along the inner wall of the vessel, resulting in a cooling effect on the wall, and a rising hot flow of these gases in the center of the vessel.

In this configuration, it is essential to have three or more lances protrude into the upper part of the vessel at a distance from the wall of the vessel leaving enough space between the end portions of the lances and the wall to be able to generate a substantial downwardly directed flow of post-combusted gases. Three lances is the minimum number for controlling the position of the upwardly directed flow of post-combusted gases in the centre of the vessel. With less than three lances it is more likely that at least part of the flow will occur in upward direction along the inner surface of the side wall of the vessel. Furthermore, in the invention at least one of the lances is designed for emitting a plurality of jets of oxygen containing gas from its end portion providing an emission action over a wider surface area of the contents in the vessel during operation. Additionally, at least one lance is arranged such that the emitted oxygen containing gas is directed towards the central axis of the vessel.

The foreign application corresponding to Klaassen et al. is discussed by the specification at the paragraph bridging pages 1 and 2. Klaassen et al., col. 2 lines 30-35, states in a preferred embodiment the means for supplying oxygen consists of a single lance extending vertically at a central region of the vessel. This allows the oxygen always to be supplied to the metallurgical vessel at the same place above the slag layer even when the level of slag varies.

Moreover, Klaassen et al. at col. 2, l. 36-46 states in another preferred embodiment, if a multiple lance arrangement is used, then the lances are oriented as much as possible

vertically thereby achieving the effect that the supply of oxygen to the metallurgical vessel still takes place as much as possible in the same place above the slag layer as would be the case with one central lance.

It is submitted this teaches away from the present invention. As stated on page 2, lines 27-30 of the present application, a single central lance arrangement or a vertically oriented multiple lance arrangement creates strong expansion of the gases in the centre of the vessel. This results in a flow of hot combustion off gases towards the side walls and then up the side walls of the vessel. As a consequence the inner surface of the side wall will be subjected to substantial heat loads. Klaassen et al. therefore proposes to cool these side walls in the top part of the vessel with cooling water pipes (col. 1, l. 46-50). Klaassen et al. is silent about any flow direction of the post-combusted gases. At col. 1, lines 58-60, Klaassen et al. teaches "while the heat loss of the post-combustion in the top part of the metallurgical vessel is absorbed by the cooling pipes" it is evident that the hot post-combusted gases are intended to flow from their lower generation zone in upward direction along the side wall of the vessel to allow the heat to be absorbed.

This is contrary to the teaching of the present claimed invention.

Moreover, Figure 2 of Klaassen et al. shows the ends of the lances extend into the foaming slag (identified by "19"; see also Col. 3, lines 44-46). Blowing oxygen containing gas into the foaming slag will maintain the generation of foam, or may even increase the intensity of foaming. In either case, the position of the lances extending into the foaming slag would prevent the generation of a direction controlled flow of post-combusted gases according to the claimed invention.

B. Klaasen et al. does not disclose, either explicitly or implicitly, at least one lance comprising means for emitting a plurality of jets

In regards to claim 2 (now incorporated into claim 1, the Office action asserts Fig. 2 and col. 2, lines 36-46 teach at least one of the lances is provided with means for emitting a plurality of jets of oxygen containing gas from its end portion. Fig. 2 is alleged to show a plurality of jets emitted from the end of lance 23.

It is urged Klaassen et al. does not disclose, either explicitly or implicitly, at least one of the lances is provided with means for emitting a plurality of jets of oxygen containing gas from its end portion. Figs. 2 and 3 of Klaassen et al. do not show means for emitting a plurality of jets. Applicants submit the images shown in Klaassen et al., are more likely to represent one diverging stream of gas emitted from each lance end than a plurality of jets as

shown in Figure 5 of the present US application.

Moreover, Klaassen et al., col. 2, lines 36-46 does not teach multiple streams from a single lance.

C. Klaassen et al. does not disclose or suggest a height adjustable lance

Applicant also submit Klaassen et al. does not disclose or suggest at least one of the lances is adjustable in height, as now recited in amended claim 8.

Applicant respectfully submits Klaassen et al. neither discloses nor suggests each element of the vessel of claim 1, as amended, and the claims dependent thereon, and these claims are therefore not anticipated by Klaassen et al. Applicant therefore respectfully requests this rejection over Klaassen et al. be withdrawn.

III. 35 U.S.C. §103

A. Claims 12-14 have been rejected as being unpatentable over Klaassen et al.

In regard to claim 12, the Office action asserts Klaassen et al. teaches the vessel of claim 11 wherein each feed chute is positioned between the lance and the sidewall of the metallurgical vessel. Klaassen et al. does not disclose the positioning of the feed chute and the lance in a radial direction, but Klaassen et al. is said to teach positioning of the feed chute in the substantially downward flow of the post-combusted gas. It is thus urged it performs the same function as the feed chute in claim 12 and therefore it would be obvious to one skilled in the art to position the feed chute between the lance and the sidewall in a radial direction after routine experimentation to optimize the position.

Claims 13 and 14 recite the metallurgical vessel comprising a lower portion for accommodating a molten metal bath and a slag layer and an upper portion for accommodating a slag layer and recite the plurality of tuyeres are for supplying gas/or liquid and/or solids and/or plasma into the slag layer in the lower portion of the vessel. The Office action deems these features as only intended uses and therefore does not give them patentable weight. The Office action recognized, in comparing Fig. 2 of Klaassen et al. and the instant invention, the tuyeres for supplying gas and/or liquid and/or solids and/or plasma into the slag layer are not in the exact position in the vessel. However, the Office action asserts it would be obvious to one skilled in the art to position the tuyeres in an optimal position as a matter of routine experimentation as a matter of routine optimization to ensure the quality of the final product.

Applicant urges Klaassen et al. does not disclose or suggest the arrangement of the lances in the vessel in independent claim 1 for the reasons set forth above in Section II and Klaassen et al. does not recognize the need to arrange the lances to produce a flow of the post-combusted gases through the center of the vessel versus the side walls which are cooled with water pipes. Consequently, there is no motivation in Klaassen et al. to position the tuyeres to "optimize" the positioning of the tuyeres in the manner taught and claimed in the present invention when Klaassen et al. is relying upon a different means for directing the flow of post-combusted gases to the side walls of its vessel.

B. Claim 15 has been rejected as being unpatentable over Klaassen et al. in view of Beggs et al. (US 4,248,408)

The Office action asserts Klaassen et al. discloses the metallurgical vessel according to claim 13, but Klaassen et al. does not teach the tuyeres comprise oxy-fuel burners. Beggs et al. is relied upon for disclosing a multiplicity of oxy-fuel burners positioned peripherally in the lower region of a furnace used to melt reduced iron and associated slag (Col. 4, lines 3-23). It is asserted it would be obvious to one skilled in the art to use tuyeres comprising oxy-fuel burners because the modification would allow the industry to make efficient tuyeres via a cost effective manufacturing process by utilizing known techniques.

Beggs et al. does not make up for the above noted deficiencies of Klaassen et al. Beggs et al. relates to a shaft type reduction furnace which is different from the vessel in Klaassen et al. and the present claimed apparatus. In particular, in Beggs et al. the furnace has no lances which would allow the directed flow of post-combusted gases. The oxy-fuel burners 94 do not extend into the furnace 10. This is also the case with the hot process gas inlet 68 and bustle 80. As a result, the gases introduced will flow upwardly. Upon reacting, "the flue gas will flow upwardly through the furnace 10 and will exit through outlet pipe" (see col. 4, line 20).

Therefore there is no teaching or suggestion for one of ordinary skilled in the art to combine Klaassen et al. and Beggs et al. Furthermore, even if the skilled person could have made such a combination despite the lack of suggestion or motivation, he would not have arrived at the claimed invention of claim 15.

IV. Conclusion

Applicant submits for the reasons set forth above, the claims, as amended, have overcome all of objections and rejections. A timely notice of allowance is therefore respectfully solicited.

Respectfully submitted,

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ATTACHMENT I – Replacement Sheet of Drawings